

REMARKS:

- 1) Referring to item 10) of the Office Action Summary, please indicate the acceptance of the drawings filed on April 1, 2004.
- 2) A few formal and clerical corrections have been made in the specification, without introducing any new matter. Entry of the specification amendments is respectfully requested.
- 3) The original claims have been canceled, and new claims 29 to 56 have been introduced. The original claims were essentially a literal translation of corresponding foreign claims. The new claims, while being based on features of the original claims, have been somewhat editorially and formally revised to bring the claims more into typical U.S. claim style and format and streamline the claim language. The new claims are supported by the original claims as shown in the following table, and do not introduce any new matter. Entry and consideration of the new claims are respectfully requested.

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|-----------------|---------------------------|----|----|---------------|----|----|----|----|----|----|
| New Claims | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 |
| Original Claims | 18 + (20 and/or 21) | 19 | 20 | 20 + 21 | 21 | 23 | 24 | 25 | 25 | 26 |

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|-----------------|----|----|----|----|----|----|----|----|----|----|
| New Claims | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| Original Claims | 27 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

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|-----------------|----|----|----|----|----|----|----|----|
| New Claims | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 |
| Original Claims | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |

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- 11 -

- 4) Referring to section 1 on page 2 of the Office Action, the election of Species 1 reading on Figs. 1 and 3 is acknowledged. Among the new claims, claims 29 to 35, 38 and 40 to 46 read on the elected Species of Figs. 1 and 3. New claims 36, 37, 39 and 47 to 56 will presumably be withdrawn from consideration as being directed to non-elected Species. Claims 29 to 31, 34, 35 and 40 to 46 are generic to all Species, and claims 32 and 33 are generic at least to Species 1 and Species 3. If a generic claim is ultimately found allowable, the Examiner is respectfully requested to rejoin, consider and allow any non-elected claims depending from such an allowable generic claim.
- 5) Referring to section 3 on page 3 of the Office Action, the Examiner's interpretation of original claims 5 to 7 as "product-by-process" claims is respectfully traversed. Actually, original claims 5 to 7 were method claims directed to a method of making the semiconductor element according to claim 1. Thus, the method-of-making claims 5 to 7 were properly dependent from claim 1. Similarly, new method claims 44 to 46 depend from claim 40 and are directed to a method of making the semiconductor element according to claim 40. Also similarly, new claims 54 to 56 depend from claim 47 and are directed to a method of making a plurality of semiconductor elements according to claim 47. These method claims must be fully examined as such, namely based on the combination of method steps recited therein. Moreover, as these method-of-making claims depend from respective product claims, the product features must also be considered when

examining the patentability of the dependent method-of-making claims (see MPEP §2116.01).

- 6) Referring to sections 6 to 16 on pages 4 to 6 of the Office Action, the rejection of claims 1, 2, 4 to 7, 18 to 21 and 26 (and apparently also claims 24 and 25 in sections 15 and 16) as obvious over U.S. Patent 6,333,522 (Inoue et al.) in view of U.S. Patent 5,900,654 (Spratt) is respectfully traversed. In view of the cancellation of all prior claims, this rejection will be discussed in connection with the new independent claim 29.
- 7) New independent claim 29 is based on a combination of features from prior claim 18 with features of prior claim 20 and/or prior claim 21. Thus, claim 29 is directed to a flip chip semiconductor element having at least two solder contacts on a contact side of the semiconductor element. These solder contacts have special features according to the invention.

First, the solder contacts respectively have different peripheral outlines. This makes it easier to visually recognize and distinguish between the different contacts (e.g. an anode and a cathode) when soldering the semiconductor element onto a circuit board. This feature can also achieve an improved stability to avoid undesired tilting of the semiconductor element in comparison to a two-point solder mount (see the original specification, e.g. at page 8 line 22 to page 9 line 14 and page 16 lines 20 to 28).

Secondly, the solder contacts respectively have the same peripheral length of the respective outlines thereof and/or the

same surface area in comparison to one another. These two alternative or supplemental second features are critical for achieving advantages of the invention as disclosed in the original specification. By ensuring that the solder contacts, despite having different peripheral outlines, still have the same peripheral length and/or the same surface area in comparison to one another, the solder-mounting characteristics are significantly improved. Particularly, these features promote a more-uniform or consistent surface tension of the molten solder during the soldering operation and avoid disturbing effects of the surface tension of the molten solder. Thereby, the plural contacts can all achieve a uniform or consistent soldered joint at each contact (see page 9 lines 16 to 25 and page 17 lines 1 to 11 of the specification).

It is important to recognize that these first and second features of the invention are defined in combination in claim 29. Namely, it is significant according to the invention that the plural solder contacts respectively have different peripheral outlines yet nonetheless still have the same peripheral length and/or the same surface area in comparison to one another. As will be discussed next, the prior art does not disclose and would not have suggested such a combination of features.

- 8) The Examiner asserts that Inoue et al. disclose most of the structural features of a semiconductor element as presently claimed.

Referring to prior claims 20 and 21, the Examiner has acknowledged that "Inoue, however, fails to specify that the

areas or the peripheral length of the contacts are the same". In this regard, the Examiner has asserted that it would have been obvious to a person of ordinary skill in the art to use such equal areas or equal peripheral lengths in the device according to Inoue et al. modified by Spratt, because "the specification fails to provide any teachings about the criticality of having contacts with the same area or perimeter".

The Examiner's assertion is respectfully traversed. As pointed out above, the specification of this application **does expressly teach** that the provision of plural contacts having the same surface area and/or the same peripheral length in comparison to one another is critical for avoiding problems that arise during the soldering process due to improper surface tension of the molten solder (see page 9 lines 16 to 25 and page 17 lines 1 to 11).

Also, the specification has taught that significant advantages are achieved by providing plural solder contacts having different peripheral outlines but the same peripheral length and/or the same surface area. Such a combination of features seems counter-intuitive on its face, and would not have been suggested by the references which are silent in this regard. Namely, by providing two contacts having different peripheral outlines, one would generally expect that those contacts would thus also have different peripheral lengths and/or different surface areas, unless special care, measurement and design efforts were taken to actually achieve the same peripheral length and/or the same surface area despite the different peripheral outlines. The present specification provides a specific teaching

and motivation for achieving this special combination of features, in terms of the criticality of these features for achieving special benefits according to the invention, as discussed above.

- 9) The prior art would not have provided any such teachings, suggestions or motivations toward the presently claimed combination of features.

Inoue et al. disclose two contacts that have different peripheral outlines as pointed out by the Examiner (see Fig. 7A). But the two contacts are shown and described as having significantly different surface areas and significantly different peripheral lengths in comparison to each other (see Fig. 7A as well as col. 16 line 67 and col. 17 lines 27 to 33). Thus, the actual example disclosed by Inoue et al. demonstrates the general or typical conventional concept that contacts having different peripheral outlines will also have different surface areas and different peripheral lengths in comparison to one another.

Moreover, Inoue et al. do not give any suggestion or motivation toward providing the same surface area and/or the same peripheral length for two or more contacts having different peripheral outlines, so as to achieve a uniform and consistent molten solder surface tension as taught by the present application, or for any other purpose. There is no suggestion that the same surface area or same peripheral length of two different contacts is even a significant feature to be considered. To the contrary, Inoue et al. generally teach only that it is desirable to minimize the area of the contacts in

order to maximize the light-emitting area of the semiconductor element (col. 9 lines 59 to 62). Inoue et al. also teach that it is important to adjust the number and/or the shape of the contacts in order to provide a stable support and mounting of the semiconductor element on a substrate so as to prevent the semiconductor element from tilting (col. 9 line 66 to col. 10 line 15). The size ranges actually taught by Inoue et al. for a "dotted microbump" circular contact (diameter of 30 to 40 μm) versus a "linear microbump" elongated contact (150 to 200 μm long by 20 to 30 μm wide) also suggest significantly different surface areas and significantly different peripheral lengths of these two different outlines of the contacts (col. 10 lines 23 to 26).

- 10) The prior art would not even have provided a motivation to investigate or try to "optimize" the surface area and peripheral length of contacts, because there is no suggestion about such factors being significant in the first place.

While Inoue et al. disclose soldering as a technique for joining or mounting the contacts onto a circuit board (col. 28 lines 15 to 20), there is no suggestion that the relative surface area or peripheral length of different contacts relative to one another has anything to do with facilitating and/or improving the soldering process and the resultant soldered joints.

From the Inoue et al. disclosure, a person of ordinary skill in the art would not have learned that the relative surface area of different contacts, and/or the relative peripheral length of different contacts are "result effective variables" that are

subject to experimentation in order to determine workable or optimum ranges of these parameters.

Routine experimentation can determine a workable range of a parameter only if the prior art gives a suggestion or motivation to adjust and optimize that parameter in the first place. That is not the case here. There are no pertinent teachings in this direction by Inoue et al., and the actual disclosures of the reference, if anything, would have led a person of ordinary skill in the art away from the inventive combination of features, for the reasons pointed out above.

- 11) The Examiner has turned to Spratt in combination with Inoue et al. for teaching the use of a glass passivation layer. Even such a teaching in combination with the disclosures of Inoue et al. (as discussed above), would not have provided any suggestion toward the significant features of the invention. Just like Inoue et al., Spratt would have provided no suggestion and no motivation toward adjusting or optimizing the relative surface area and/or the relative peripheral length of different contacts in the first place, so that there would have been no prior art motivation or suggestion to achieve the present invention by mere routine experimentation.
- 12) In the Species Election Requirement of June 1, 2005, the Examiner asserted that there are patentably distinct differences between a Species according to Fig. 3 and a Species according to Fig. 4 of the present application.

In both Fig. 3 and Fig. 4, the two contacts have different peripheral outlines in comparison to one another. However, a significant difference between these two Species is that Fig. 3 is disclosed as having contacts with different peripheral outlines yet the same surface area and/or the same peripheral length, while Fig. 4 especially shows an arrangement in which one contact has a significantly different peripheral length than the other.

With regard to the relative surface area and/or the relative peripheral length of the two contacts, the arrangement of Inoue et al. is more like present Fig. 4 than present Fig. 3. In the Election Requirement, the Examiner said that there are patentably significant differences between Fig. 3 and Fig. 4. But now, to the contrary, the Examiner is asserting that this difference regarding the relative surface area and/or the relative peripheral length of the two contacts is non-critical and thus not a patentable distinction.

As such differences were considered to be patentably distinguishing in the Election Requirement, they must now also be considered as patentably distinguishing over the prior art that does not disclose or suggest these features as defined in new independent claim 29.

- 13) For the above reasons, the Examiner is respectfully requested to withdraw the rejection of claims 1, 2, 4 to 7, 18 to 21 (24, 25) and 26 as obvious over Inoue et al. in view of Spratt, because this rejection is not applicable against any of the new claims

29 to 56. Claims 30 to 56 are patentable already in view of their dependence from claim 29.

14) Referring to sections 17 and 18 on page 7 of the Office Action, the rejection of claim 3 as obvious over Inoue et al. and Spratt further in view of JP 56-33845 (Goto) is respectfully traversed. The combination of Inoue et al. and Spratt has been discussed above. The Examiner has cited Goto for a suggestion toward an oxide layer between a glass passivating layer and an active layer. Even with such a teaching considered in combination with the above references, there still would have been no suggestion toward the significant inventive features that have been discussed above. The Examiner is respectfully requested to withdraw the obviousness rejection applying Inoue et al., Spratt and Goto, because this rejection is not applicable against any of the present new claims.

15) Referring to sections 19 and 20 on pages 7 to 8 of the Office Action, the rejection of claim 23 as obvious over Inoue et al. and Spratt in view of U.S. Patent Application Publication 2003-0032217 (Farnworth et al.) is respectfully traversed. The disclosures of Inoue et al. and Spratt have been discussed above. The Examiner has additionally cited Farnworth et al. for a discussion toward using a dummy contact. While Farnworth et al. provide spacers (50) configured to prevent tipping or tilting of the semiconductor element, there still would have been no suggestion toward the special features regarding solder contacts having different peripheral outlines yet the same surface area

and/or the same peripheral length, as defined in present new independent claim 29. To the contrary, the teachings of Farnworth et al. are directed particularly to the thickness of the contacts and the spacers, rather than relative surface areas and peripheral lengths thereof. The Examiner is respectfully requested to withdraw the obviousness rejection applying Inoue et al., Spratt and Farnworth et al., because this rejection is not applicable against any of the new claims.

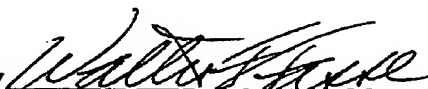
- 16) Referring to sections 21 and 22 on pages 8 to 9 of the Office Action, the rejection of claims 1 and 3 as obvious over U.S. Patent 6,127,720 (Nakura) in view of the excerpt from the Electronic Packaging and Interconnection Handbook by C. Harper is respectfully traversed. The significant features of new independent claim 29 have been discussed above. Also as mentioned above, independent claim 29 incorporates features from prior claims 18 as well as 20 and/or 21. Claims 18, 20 and 21 were not subject to this rejection based on Nakura in view of Harper. Thus, the rejection cannot be maintained against the present independent claim 29 or any of its dependent claims. Particularly, neither Nakura et al. nor Harper, nor a combined reading of these two references, would have provided any suggestion that it is significant to provide plural solder contacts respectively having different peripheral outlines yet the same surface area and/or the same peripheral length in comparison to one another. There are no pertinent teachings in this regard. For these reasons, the Examiner is respectfully requested to withdraw the obviousness rejection applying Nakura

et al. in view of Harper, because this rejection is not applicable against any of the new claims.

- 17) Favorable reconsideration and allowance of the application, including all present claims 29 to 56, are respectfully requested.

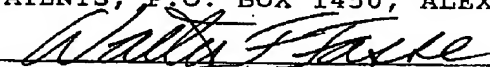
Respectfully submitted,
Franz MATHE et al.
Applicant

WFF:kd/4648
Enclosures:
Transmittal Cover Sheet

By 
Walter F. Fasse
Patent Attorney
Reg. No.: 36132
Tel. 207-862-4671
Fax. 207-862-4681
P. O. Box 726
Hampden, ME 04444-0726

CERTIFICATE OF FAX TRANSMISSION:

I hereby certify that this correspondence with all indicated enclosures is being transmitted by telefax to (571) 273-8300 on the date indicated below, and is addressed to: COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA 22313-1450.

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Name: Walter F. Fasse - Date: October 26, 2005